Performance of the Accelerate Diagnostics Blood Culture Detection System for Gram-Negative Bloodstream Infections in a Pediatric Hospital

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Background

Rapid identification (ID) and antimicrobial susceptibility testing (AST) techniques promise to improve the management of patients with bloodstream infections. We implemented the Accelerate Diagnostics Pheno blood culture detection system (AXDX) for detection of gram-negative blood stream infections (GN BSI) at the Children's Hospital of Philadelphia. Here, we describe AXDX implementation and performance in the first 8 months (Sept. 2018 - April 2019) post-implementation.

Methods

Implementation required 4 months of constant communication between the infectious disease diagnostics lab, infectious disease clinicians, antimicrobial stewardship and informatics teams. After notifying the clinician of the initial positive blood culture gram-stain result, gram-negative blood cultures were tested by AXDX and gram-positives by Verigene. 1.5hrs later, AXDX ID results are reported in EPIC but are not called. A text page is sent to the antimicrobial stewardship team ~6.5hrs later once susceptibilities are available (except from 11pm to 7am).

All positive blood cultures were also plated to 5% sheep blood, chocolate and MacConkey agars. Any additional organisms recovered were identified with MALDI-TOF mass spectrometry. Additional AST was set up based on organism ID and initial AXDX AST results.

Results

- Since implementation of the AXDX, 104 samples have been analyzed with 77.9% (n=81) organisms being on-panel (Figure 1), 21 off-panel (20.2%), and 4 failed runs (3.8%).
- 21 samples (22 organisms) were not identified by the AXDX. Four samples not identified by AXDX were identified by MALDI-TOF as *Enterobacter cloacea complex* (n=3), and *Acinetobacter baumanii* complex (n=1) (Table 1). Further ID by sequencing showed that these species were off-panel for the AXDX.
- In two instances discrepancies between Pheno and MALDI-TOF ID; *Klebsiella* spp. vs. *Leclercia* spp. and *Enterobacter* spp. vs. *Pluralibacter* spp. respectively, did not have any impact on patient care as the same MIC breakpoint interpretations applied.

Results

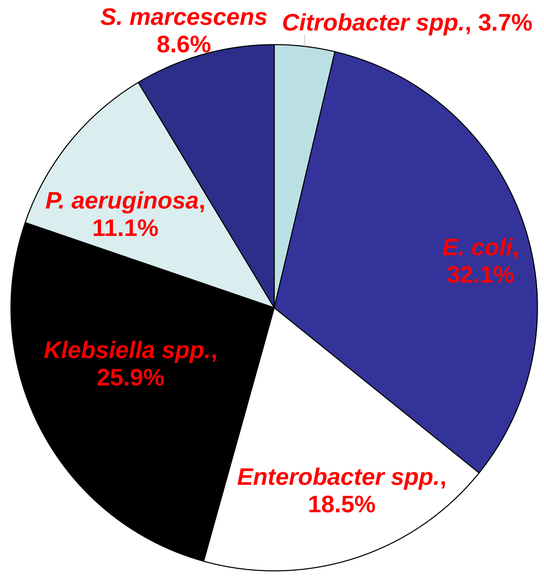

Figure 1. Distribution of on-panel organisms identified by AXDX

Organisms Not Identified by the Accelerate Pheno	Frequency
*Alcaligenes xylosoxidans**	1
Achromobacter spp.	1
Acinetobacter baumanii complex	1
Capnocytophaga spp.	1
Chryseobacterium spp.	1
Enterobacter cloacae complex	3
Haemophilus influenzae	2
Moraxella nonliquefacciens	1
Neisseria meningitidis	1
*Oligella urethralis**	1
Pantoea spp.	1
Leptotrichia spp.	1
Pseudomonas putida group	1
Roseomonas mucosa	2
Salmonella spp.	2
Stenotrophomonas maltophilia	2

* Isolates from the same culture, the rest were monomicrobial BSI

Table 1. Distribution of organisms not identified by AXDX

Results

Organisms Identified by the Accelerate Pheno	Additional Organisms Identified by Routine Culture
(A) *Klebsiella* spp.	*E. coli*
(B) *Klebsiella* spp.	*Enterobacter cloacae complex*
(C) *Klebsiella* spp.	*Enterobacter cloacae complex*
(D) *Klebsiella* spp.	*Corynebacterium striatum, Chryseobacterium* spp.
(E) *S. Marcescens*	*Klebsiella pneumoniae*

Table 2. Organisms identified by routine culture in addition to those identified by AXDX.

- In 5 samples, additional gram-negative organisms were identified by routine culture that were not identified by AXDX. In 3/5 (B-D) instances the instrument made a monomicrobial call

Clinical Implications:

- Table 2 shows two instances (A and E) where AXDX clearly missed a polymicrobial BSI. In both instances AXDX detected the most resistant organism and no further change in antibiotics was warranted
- One instance of an ESBL-*Klebsiella* spp. ID'd on AXDX and an *Enterobacter* spp. by culture, made the team question if the patient could be switched from imipenem to cefepime. No change was made and the *Enterobacter* was pan-susceptible by Vitek.

Conclusions

- Overall AXDX evaluation took 3 months and implementation, from interface request to go-live, took 4 months.
- The system has performed as expected for the detection of monomicrobial GN BSI with company updates reducing the indeterminate call rate seen with earlier software versions.
- The overall incidence of polymicrobial gram-negative bacteremia at our institution is low.
- Due to known system limitations we do not report monomicrobial calls and if both gram-positive and gram-negative organisms are seen by gram-stain these samples are not tested on the AXDX.

*Dr. Cardenas received honorarium from AXDX and is now an employee of BD